Naval Surface Fire Support: Meeting Operational Maneuver From The Sea And Future Requirements

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EXECUTIVE SUMMARY

Title: NAVAL SURFACE FIRE SUPPORT: MEETING OPERATIONAL MANEUVER FROM THE SEA AND FUTURE REQUIREMENTS

Author: CDR Eric R. Hinger, USN

Thesis: The Navy's near- and long-term development programs will fall short of Operational Maneuver from the Sea (OMFTS) and Ship-to-Objective Maneuver (STOM) requirements in three specific areas: (1) range for naval gunfire, (2) response time of long-range fire support mission, and (3) an inexpensive volume-fire long-range munition.

Discussion: The near-term program, a modification to the 5-inch/54 caliber gun mount, will enable the system to fire an extended range guided munition (ERGM) to 63NM. The long-term programs incorporate a 155mm gun system with ranges up to 100NM and a land-attack missile system for targets ranging from 100 to 200NM. OMFTS and STOM concepts project insertion ranges for the MV-22 out to 200NM. Implementation will require the capability to range enemy indirect fire systems beyond 200NM that can fire on the landing zones.

Response time for call fires (the time from request to detonation on target) must be minimized. Extensive innovation in target processing is occurring leaving the time of flight for extended range munitions as the largest factor. Call fire response time should be maintained at 2 – 10 minutes. The time of flight to 63NM is eight minutes for the 5-inch ERGM under development. Without decreasing time of flight, adequate response time is unattainable for 63NM, and impossible for 200NM.

Volume fires are required for harassing, suppressing and area fire missions in support of forces ashore. The production cost of the 5-inch ERGM and land attack missile are anticipated to be $5,000 and $300,000, respectively. These prices are excessive for volume fire missions where the requirement is a steady rain of munitions on a target area, not precision guidance to a target

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Conclusion: It is imperative that continued developments occur in range, response time, and a low-cost volume munition with increased range. Without these improvements, Marines operating at the ranges anticipated in OMFTS and STOM will be unnecessarily exposed to enemy fires throughout all phases of an amphibious operation.

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Operational Maneuver from the Sea (OMFTS) has defined new parameters for the maneuver capabilities of Marine forces ashore, and the fire support requirements for those forces. "A Concept For Advanced Expeditionary Fire Support — The System After Next" integrates OMFTS and fire support as follows:

OMFTS From a Fire Support Perspective

- **A single, integrated, seabased command and control system will provide a common, real-time battlefield picture to commanders and fire support elements, links to target acquisition and intelligence systems, and coordination and control for aviation, naval surface and ground-based fires.**
- **All fire support systems will be sustained primarily from the sea.**
- **Fires will both enable and exploit maneuver.**
- **Fire support will be capable of providing a range of effects appropriate to the situation, including non-lethal fires.**
- **Complementary aviation, naval surface, and ground-based fire support systems will provide flexible, reliable, and synergistic fire support.**
- **Naval surface fire support will provide long-range, accurate fires to shape the battlespace and support the maneuver force.**
- **Aviation fires will support both the close and deep battle. Naval aviation will be capable of operating ashore from expeditionary airfields when advantageous.**
- **Ground-based fires will provide mobile, responsive, all-weather support. They will directly support ground operations and facilitate aviation and naval surface fires, for example, by suppressing enemy air or antiship defenses to enable delivery of friendly aviation and naval surface fires.[1]**

[1] Commanding General, Marine Corps Combat Development Command, A Concept for Advanced Expeditionary Fire Support — The System After Next, Concept Paper (Quantico, VA: Marine Corps Combat Development Command, January 1998), 6.

Naval Fire Support during amphibious operations is no longer just the use of naval guns to aid in the establishment of a beachhead for the Marine landing forces. Naval Fire Support has come to incorporate supporting fires:

> provided by an assortment of naval weapons systems (guns, missiles and TACAIR [tactical aircraft]) from a number of platform types (DDGs, CVs, SSNs, etc.) and is now viewed as support for ground force operations from the sea.[2]

The triad of Naval Surface Fire Support (NSFS), TACAIR and artillery organic to the maneuvering force is the total fire support package for OMFTS. This paper will concentrate on the NSFS portion of this triad, which includes naval guns, missiles and rocket systems, that is being developed to meet OMFTS requirements.

The Navy does not currently operate any weapon systems that can meet the NSFS requirements for OMFTS. In 1983, the Commandant of the Marine Corps told the House Armed Services Committee that "currently our naval guns are deficient in size and number and are considered inadequate."[3] The only land attack weapon on today's surface combatants is a 5-inch/54 caliber gun with a

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[2] Johns Hopkins University Applied Physics Laboratory, Naval Surface Fire Support Road Map Study Phase 1 Report, Study, VS—96—005, October 1996, ES—11.

[3] U.S. Congress, House, House Armed Services Committee, Statement of Robert H. Barlow, Commandant of the Marine Corps before the House Armed

maximum range of l3NM that fires an unguided, ballistic round.[4] These guns are capable of firing 20 rounds per minute and are fitted on all current classes of Cruisers and Destroyers totaling 116 surface combatants.[5]

The Navy's near-term programs include modifying the current gun and developing a long-range munition that will provide a limited fire support capability by FY 2004. The long-range programs of a vertical gun system and a surface launched land attack missile will reach inception in FY 2009. OMFTS is expected to reach its operational employment capability in FY 2010, imposing a requirement for NSFS that far exceeds the near—term capabilities. The Navy's long-term development programs will also fall short of OMFTS requirements in three specific areas: (1) range for naval gunfire, (2) response time of long—range fire support missions, and (3) an inexpensive volume-fire long-range munition.

Services Committee on Marine Corps Posture, Plans and Programs for FY 1984 through 1988, 98th Cong., 1st sess., 1983, 9.

[4] CAPT J. W. Townes, III, USN, "Navy Surface Fire Support: On Target," Surface Warfare 22, no. 1 (January/February 1997): 24.

[5] MAJ Marc F. Riccio, USMC, "Naval Surface Fire Support," brief presented at USMC Command and Staff College, Quantico, VA, 20 February 1998.

WHAT IS NAVAL SURFACE FIRE SUPPORT

Naval Doctrine Publication 1 defines NSFS as "accurate, all-weather fire support ... augmenting air—delivered strike munitions in the destruction of enemy emplacements, systems and personnel."[6] This statement describes only the mere basics of the entire realm of NSFS. Joint Publication 3—09 more inclusively states:

> Fire support is defined as fires that directly support land, maritime, amphibious and special operations forces to engage the enemy to delay, disrupt, neutralize, or destroy enemy forces, combat formations, and facilities in pursuit of tactical and operational objectives.[7]

Coupling these broad definitions of supporting fires to the role of a naval surface unit conducting these fires leads to defining NSFS as any fire; neutralizing, destructive, harassing, interdicting or suppressing;[8] fired from a naval surface combatant to support the ground battle. These fires include naval guns and missiles, and all of the various types of submunitions and warheads that may be employed.

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[6] Naval Doctrine Publication (NDP) 1, Naval Warfare (Washington, DC: Department of the Navy and Headquarters United States Marine Corps, March 1994), 67.

[7] Joint Publication (JP) 3—09, Doctrine for Joint Fire Support (Washington, DC: Joint chiefs of Staff, July 1997 (DRAFT)), I—2.

[8] See Appendix A for definitions of fire support types and tactical employment.

These guns or missiles will be used in all types of fires (area, call, precision), tactics (close support, defensive, screening) and fire effects (destruction, interdiction, suppression) to support the ground forces in their maneuvers and engagements ashore. Fire support is employed in either the direct or general support role. Direct support is the designation of a fire support platform (or battery) to a specific battalion-size ground unit to supply fire support for either prearranged or call fires. General support provides fires for units of regiment size or larger from a single platform (or battery) to provide prearranged fires or fires on targets of opportunity from the Naval Gunfire (NGF) plans.[9] The fundamental uses of fire support will focus on the enemy, not the terrain; act more quickly than the enemy can react; and support maneuver by fire.[10] The surface combatants will enable the forces ashore to reach their objective and accomplish their assigned mission under the protective umbrella of NSFS.

Certain effects of fires require varying volumes of fire. For destruction fires, with an accurate target

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[9] Naval Warfare Publication (NWP) 3—09.11M, Supporting Arms in Amphibious Operations (Norfolk, VA: Naval Doctrine Command, March 1995), 2-2. (Complete definitions in Appendix A.)

position and using the precision guided munitions under development, it is possible to achieve a one round one kill ratio. Other effects, suppression or harassing fires, require a larger volume of fire. For example, if the purpose of harassing fires is to interrupt enemy operations or sleep by continuous bombardment, accuracy is not critical, shells only need fall in the general area occupied by the enemy, but they must due so continuously over a period of time.

NSFS FUTURE CONCEPTS IN JOINT AND SERVICE DOCTRINE

In future operations, NSFS will be required to provide a "long-range precision capability combined with a wide variety of delivery systems ... [to] increase the combat power available for use against selected objectives."[11] The Navy "will deliver integrated joint fires with enhanced range, lethality, accuracy and timeliness from aircraft, ships and submarines for any type mission."[12] These concepts of long-range fires delivered with exceptional

[10] Fleet Marine Force Manual (FMFM) 2-7, Fire Support in Marine Air Ground Task Force Operations (Washington, DC: Headquarters United States Marine Corps, September 1991), 3-2.
[11] Chairman of the Joint Chiefs of Staff, Joint Vision 2010 (Washington, DC: GPO, 1996), 11.
[12] Chief of Naval Operations, Forward … from the Sea (Washington, DC: GPO, 1997), 7.

accuracy far out-reach current capabilities and define new employment concepts for NSFS. The concept expressed in both of these statements is the continuing need to increase the standoff ranges and accuracy of the munitions employed.

OMFTS takes these principles one step farther in espousing the need to provide a "sustainable, forcible entry capability that is independent of forward staging bases, friendly borders, overflight rights and other politically dependent support."[13] Operations of this sort can only be conducted with adequate NSFS. TACAIR will be available if the Carrier Battle Group is present during the operation, but carrier operations are limited by weather and sortie generation capabilities.

Operating in an OMFTS scenario, with no friendly support bases available, the establishment of a beachhead may not be desired or even required. A concept under development by the Marines, Ship-to-Objective Maneuver (STOM), will allow mission accomplishment without establishing the beachhead. The movement of forces directly to the objective will increase range requirements farther than the "beyond the horizon" requirements of OMFTS. The surface ships will be required to avoid a

[13] United States Marine Corps, Operational Maneuver from the Sea (Washington, DC: GPO, 1996), 1.

hostile coastline while supporting forces at the objective area well inland from the beach.[14]

The Marine forces in the STOM scenario will be lightly equipped and required to rely on NSFS as they would their own organic artillery in current tactics. The emphasis of NSFS "will be on destruction, harassment, interdiction and suppression fires in support of Advanced Force operations."[15] This requirement does not change the conventional roles of NSFS, the ranges, however, continue to expand with each new concept of force employment. As possibly the only platform on scene capable of supplying supporting fires, the range, accuracy and lethality requirements for NSFS become critical to mission success.

The previously described concepts all deal with limited engagements of tactical units and their NSFS requirements. A future operation may still involve large forces and require a forcible entry to establish a beachhead for sustainability, and the movement of troops ashore via the beachhead. Fire support missions of destruction, suppression and area fires will be necessary to establish the beachhead. NSFS capabilities must not

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[14] United States Marine Corps, A Concept for Ship-to—Objective Maneuver (Washington, DC: GPO, 1997), 5.

[15] **C**ommanding General, Marine Corps Combat Development Command letter to Chief of Naval Operations (N86 and 85), 3900/C44, subject: "Naval

only be able to meet long-range precision requirements, but maintain the capability to engage a heavily defended landing site at the water's edge. General Weller points out:

> Important lessons stemming from World War II, Korea and Vietnam are valid for future amphibious assault operations. The most important lessons are (1) the necessity for destruction of beach defenses, blockhouses, pill boxes, coast defense guns and other hard targets; and (2) the requirement for the closest possible integration of fire support with the ship-to-shore movement.[16]

As a consequence of the developing concepts for NSFS employment, the Chief of Naval Operations (N864) initiated the Johns Hopkins University Road Map Study Phase 1 in 1995 to investigated the range, lethality and types of fire requirements for NSFS. This study looked to the Marine Corps and Navy for guidance on the employment and capabilities required for future NSFS systems. The combination of the attributes required of NSFS for OMFTS and the classic assault of the beach used in this study were taken from the 1992 Naval Sea Systems Command's NSFS Mission Needs Statement:

- engage fixed and mobile targets from Over the Horizon (OTH)

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Surface Fire Support for Operational Maneuver from the Sea," 3 December 1996.

[16] MGEN Donald M. Weller, USMC, (Ret), "Background," unpublished introductory chapter to uncompleted book concerning Naval Seapower Projection, (Circa 1983), 17.

- achieve mission kills vs. hard, mobile or point targets and dispersed targets
- provide accurate area saturation and neutralization fires
- counter enemy force artillery threat to inland helo-bourne assault forces
- provide interdiction capability to the assault force
- engagements are time critical
- may consist of guns, ballistic rockets and/or guided missiles[17]

Together these employment concepts and the requirements that result provide the guidelines for a NSFS system to meet the challenges of supporting forces ashore on the future battlefield.

NSFS FROM PAST TO FUTURE

To fully understand the development of current and future NSFS employment, an examination of past strategy and tactics is in order. World War II resulted in the refinement of the NSFS techniques and criteria that are still in use today. The tactics for an amphibious assault consisted of four basic steps: (1) seize the beach, (2) defend the beach, (3) transfer power ashore, and (4) break out of the beachhead. These four steps were used with

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[17] Confidential Memorandum for the Commander, Naval Sea Systems Command, subject: "Acquisition Decision Memorandum for the NSFS Program," 24 November 1992, as quoted in JHU, "Road Map Study, Phase 1," 3 - 5.
[18] Naval Surface Warfare Center, Naval Surface Fire Support Study, Study, NSWCDD/TR—92/667, July 1992, 6.

great success in the Pacific and European theaters. The main difference in their execution was the differing emphasis placed on preliminary bombardment.

These steps have been used since World War IT, notably the amphibious assault at Inch'on, Korea in 1950. The fire support ships followed the landing forces in with the tide on both the initial and main assault waves to provide pre-planned and interdicting fires. The surface ships continued to provide fire support throughout the initial maneuvers ashore as long as the ground forces and targets were within range.[19]

The experiences of amphibious operations from World War II to the present have established what General Weller terms certain broad prerequisites." These are:

> A clear measure of fire superiority. An adequate inventory of Naval guns, missiles and aircraft to either destroy or continuously neutralize enemy forces that can seriously interfere with the Movement to Amphibious Objective Area, the Debarkation and Ship-to—Shore Movement, the Attack of the beaches and helicopter landing zones and the Consolidation of the Beachhead.[20]

In terms of today's concepts, NSFS for defense of the beachhead or objective area have the same requirements as historical assaults. Fires must be present in adequate

[19] Roy E. Appleman, South to the Naktong, North to the Yalu, (Washington, DC: Center of Military History, 1992), 502 — 507, 512, 513.

quantity to ensure the enemy cannot interfere with the ship-to-shore/objective movement and defend the forces until their own artillery is in place or to act in place of organic artillery, directly supporting the maneuvering forces.

EXECUTION OF MANEUVERS AND FIRES

The main purpose of supporting fires in both the OMFTS and STOM concepts is to protect the ground forces and enable them to maneuver ashore. Joint Publication 3-09 states: "Successful maneuver requires fires and movement. Fires neutralize, destroy and suppress enemy forces and disrupt enemy maneuver which permits the maneuver of friendly forces."[21] Regardless of the type of fire effect or tactic, the end result is facilitating maneuver. Ground forces must move to attain their objective, whether securing an area; or defeating hostile forces. As long as their movement is opposed, NSFS will be required.

To ignore the requirement for, or through other circumstances not supply fire support, is tantamount to disaster. In 1975 the United States was involved in the

[20] Weller, "Background," 1.
[21] JP 3—09, I—9.

rescue of an American tanker, the MAYAGUEZ, which was taken by the Cambodians. In the rescue attempt, a helo-bourne assault on the island of Koh Tang was conducted in an effort to free the ship's crew. The rescue plan assigned 2 ships for Naval Gunfire Support (NGFS) to cover the rescue operation.[22]

A moderate sized force of approximately 150 defending Cambodians with small arms virtually defeated the first wave of eight helicopters. Three helicopters were shot down; another was unable to unload and a fourth required an emergency landing in Thailand after unloading. Only 73% of the landing force reached the island and 100% of the helicopters received major damage from small arms fire. The first wave of the assault was performed without any supporting fire from the assigned ships.[23]

This episode demonstrates the devastating effects of even small arms when a landing of any type is opposed. Even the minimum of undirected suppressive fires in the vicinity of the landing zones would have eliminated or greatly reduced the small arms fire. To expect that any future insertion into a hostile area will be completely unopposed will leave the forces unnecessarily exposed to

[22] Center for Naval Analyses, The Mayaguez Operation, Study, CSN 1085, April 1977, 5—14.
[23] CNA, Mayaguez Study, 5-14.

enemy fire. Future operations into enemy territory, whether to the beach, or well inland to the objective area, must be adequately supported by fires.

ORIGIN OF FUTURE CAPABILITIES PROGRAMS

In the early 1990's the issue of NSFS again was pushed to the forefront when the battleships were retired after DESERT STORM[24] and there were serious doubts that the only two left mothballed would ever be recommissioned again because of the costs. The Center for Naval Analyses (CNA) was commissioned to perform a study of the NSFS mission and the weapon systems available to determine the best course of action for incorporating these systems on new surface ships.

This study, "The NSFS Cost and Operational Effectiveness Analysis (COEA)," used a 75NM range to the target with possible excursions to 100NM as the requirement for an NSFS system.[25] The end result of the analysis was that the Navy should incorporate a 155mm gun with an

[24] Townes "NSFS: On Target," 24.

[25] The COEA used a target driven analysis in Korean and jungle type scenarios. The ships were initially positioned at 25NM from the shore with excursions in and out as defensive postures required leading to target distances of 75 to 100NM. Bill Morgan and others, Program Analyst at Center for Naval Analyses, interview by author, 7 November 1997.

Extended Range Guided Munition (ERGM) in tandem with the current TOMAHAWK cruise missile for long-range strike. This gun would incorporate joint technology development, would be the same size and caliber as Army and Marine Corps field artillery, and meet the direct and general support mission requirements of the OMFTS and STOM concepts.[26]

One key criteria of the COEA that led to selection of the 155mm gun was that it would only be incorporated on new construction and not back-fit onto existing surface combatants. Based on the building plans for new surface combatants this course of action was deemed unacceptable due to the delays in attaining a long-range NSFS capability. The CNA was asked to revisit the choice of gun systems for affordability and backfit into the AEGIS Cruiser and into the newly developed DDG 51 ARLEIGH BURKE Class destroyer. The options under consideration included the 155mm gun selected in the COEA, the current 5"/54 gun system, or a modification to the current gun system that included a change to the barrel making it a 5—inch/62 caliber gun (5"/62). The Navy chose the 5"/62 gun with an ERGM round to meet a reduced 63NM range capability.[27]

This choice, though meeting a more acceptable time-line, posed a new problem: how to meet fire support

[26] Morgan interview.

requirements out to l00NM or farther. Current technology required the development of another new system in addition to the gun, a land attack missile for NSFS to meet these extended ranges.[28] In 1995 the Government Accounting Office (GAO) examined the Navy's course of action and countered that the "Navy [was] unable to show the decision will meet NSFS requirements or provide most cost effective means."[29] Not until the end of 1996 when the Marine Corps published its NSFS requirements was the range for NSFS reduced from the initial ranges of 75 to l00NM of the COEA to within the 63NM range of the 5"/62 gun.[30] The Navy now had a near-term solution to the NSFS problem that met documented Marine Corps direct and general fire support requirements.

CURRENT NSFS PROGRAMS

After investigating a number of probable solutions to correct the lack of a NSFS system, the Navy has implemented several programs over the past few years. The immediate, near—term solution to NSFS is the 5"/62 gun with an ERGM round. The long-term goal is a 155mm Vertical Gun for

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[27] Morgan interview.
[28] Townes "NSFS: On Target," 25.
[29] Government Accounting Office, Naval Surface Fire Support — Navy's Near Term Plan is not Based on Sufficient Analysis, Study, GAO/NSIAD—95—160, May 1995, 3.

Advance Ships (VGAS) and a ship launched land attack missile.

The 5-inch/62 Caliber Gun

The 5"/62 is a modification to the existing 5"/54 gun system. This modification is required to fire the ERGM round due to the increased energy expended firing the munition. The upgrade includes strengthening the gun slide, supports and recoil system; and a 40—inch increase in the barrel length. This modification will provide an increased muzzle velocity and enable the gun to absorb the increased energy of firing rocket propelled munitions. The modified gun system will still be capable of firing the shells from the current 5"/54 to the same 13NM range.[31]

Extended Range Guided Munition

Performance. The ERGM round fired from the 5"/62 gun, figure 1, is a 61—inch ballistically fired, rocket propelled, gliding round that uses Global Positioning System/Inertial Navigation System (GPS/INS) guidance. To launch, the weapon is fired directly upward at maximum gun elevation and the rocket motor is engaged, using the gun system as a launching pad rather than an aiming platform.

[30] Commanding General MCCDC letter to CNO (N86 and 85)

The GPS/INS begins to align during the ascent phase to fix the round's position and stabilize the weapon.[32] To attain its maximum range of 63NM, the round may attain altitudes of up to 80,000 ft and requires a time of flight of up to 8 minutes to reach the target.[33] The weapon glide provides the increased range.

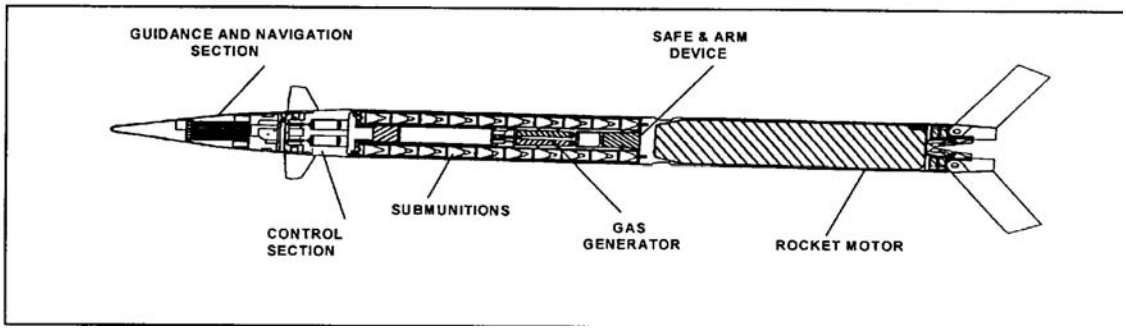

Figure 1. Extended Range Guided Munition Round

Source: Program Executive Office, Naval Surface Fire Support (PMS 429), Concept of Employment for Naval Surface Fire Support (Near-Term Capability), Draft Concept Paper, (Washington, DC: Naval Sea Systems Command, March 1997), 9.

The glide profile requires INS stabilization to orient the weapon and maintain correct windstream alignment. Without an INS the rocket assisted munition could be fired ballistically. The maximum gun elevation of 650, and rocket motor would still allow the weapon to attain its

[31] Townes, "NSFS: On Target," 25.
[32] J. Gary Ferrebee, Program Manager for NSFS, Naval Surface Warfare Center, Dahlgren Division, interview by author, 12 March and 11 April 1998.
[33] Morgan, interview.

maximum altitude. The range would be reduced by at least half without an INS to orient the weapon and provide glide stabilization because the weapon would only attain a ballistic trajectory.[34]

The 5"/62 and ERGM combination is currently planned to be deployed on new construction DDG 51 ARLEIGH BURKE Class ships which will reach the fleet beginning in FY 2002. A total of 23 DDG 51 ships will be built with a single gun mount each. The dual gun configuration will be back-fitted on 12 AEGIS Class Cruisers, the first reaching the fleet in FY 2004.[35]

Submunition. Based on the 5-inch diameter of the ERGM round, it carries a 32-pound submunition payload. The developmental warhead is made up of the XM-80 Dual Purpose Improved Conventional Munition (DPICM). The DPICM "bomblets" are a 1 h-inch dual purpose shaped charge designed for soft materiel and personnel targets; the ERGM will carry 72 bomblets. Follow-on submunitions will include High Explosive (HE) and a hard-target penetrator.[36]

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[34] Ferrebee interview.
[35] MAJ Marc F. Riccio, USMC, "Naval Surface Fire Support Update," brief presented at USMC Artillery Detachment, Fort Sill, OK, 22 October 1997.
[36] Ferrebee interview.

Comparing the DPICM warhead to the current 70-pound HE round[37] fired by the 5"/54 requires consideration of several factors. First, lethality is a function of the ability to place the warhead close to the target. The current HE round from the 5"/54 is accurate in azimuth, but can have up to a 150-meter variance in range when firing at the same coordinates. The ERGM will meet a threshold requirement of 20 meters with a goal of 5 meters Circular Error of Probability (CEP).[38]

Second, the target must be within the explosive range of the submunition. With a 150 meter variance, the target can easily be outside the blast of the 5"/54 HE projectile. The ERGM design includes a selectable dispersion radius for the submunition from 50 to 100 meters in 10—meter increments. The combination of a 20-meter CEP and a 50-meter dispersion guarantee the target will be within the range of the submunition. Anticipated gain of effectiveness of the ERGM compared to the 5"/54 round is at least 10:1 for enemy troops in the open.[39]

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[37] Naval Surface Fire Support Program Technical Review, Naval Surface Fire Support Technical Review, 6—8 December 1994 (Dahlgren, VA: Naval Surface Warfare Center, 1995), TS-l.
[38] Ferrebee interview.
[39] Ferrebee interview.

Cost. The weapon currently undergoing testing costs the Navy $17,000 per round. The factors in the price of the round are the volume produced and complexity of the components. Due to the small number of rounds produced for testing, the price of these units is not indicative of final production costs.

The most expensive component of the round is the INS Inertial Measuring Unit. There are several factors in future production volumes that could reduce the price substantially, mainly a commercial requirement for the same miniaturized components as the Navy and competitive production. The projected requirements for Navy and Army guidance systems as well as a commercial requirement is expected to ultimately reduce the price of the ERGM to $5,000 per round.[40]

The 155mm Vertical Gun for Advanced Ships

The 155mm VGAS is a below-deck mounted 155mm gun system with self-contained munitions storage. As depicted in figure 2, the system will have two gun barrels and contain 1400 to 1500 ERGM rounds. VGAS will occupy the equivalent deck space of a 64 cell vertical launch system.

[40] Hagan, Dennis, Lead Government Systems Engineer for the NSFS Program, Naval Surface Weapons Center, Dahlgren Division, interview by author, 12 March 1998.

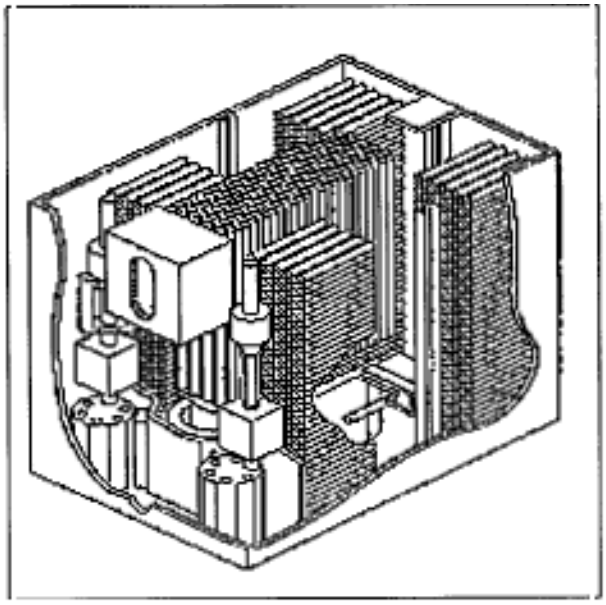

Figure 2. Vertical Gun for Advanced Ships

Source: MAJ Marc F. Riccio, USMC, "Naval Surface Fire Support Update," brief presented at USMC Artillery Detachment, Fort Sill, OK, 22 October 1997.

The increased size of the 155mm ERGM round will extend ranges to 100NM. Design requirements also call for increased accuracy and lethality due to a larger payload capacity than the 5"/62 ERGM round. The 155mm ERGM will carry the same DPICM submunition as the 5-inch version. The 144—180 XM-80 bomblets will provide the equivalent destructive power as the 88 M-42 bomblets of the DPICM

currently fired in 155mm artillery, the increased number is due to the smaller size of the individual bomblets.[41]

There are still several munitions in competition for the Navy 155mm ERGM program offering a variety of times-of-flight to target (the Operational Requirements Document calls for 100NM in less than 6 minutes[42]) and different types of submunitions to meet the lethality requirements for various target types. Another key requirement for the VGAS system is that it must be able to resupply its munitions while underway.[43]

The Ship Launched Land Attack Missile

There are still several missile systems vying for the Navy's land attack missile role. Range requirements for the missile are 100 to 200NM. The Army's tactical missile system has already been demonstrated as compatible with the Navy's planned employment and it has been successfully fired from a vertical launch cell at the White Sands, NM test facility.[44] Other missiles include the Sea SLAM and a

[41] Ferrebee interview.
[42] Chief of Naval Operations, Operational Requirements Document Draft for The Vertical Gun for Advanced Ships Weapon System, 5 December 1997, 3.
[43] CNO ORD for VGAS, 3 - 4.
[44] MAJ Marc F. Riccio, USMC, Naval Surface Fire Support Requirements Officer at Chief of Naval Operations (N853), interview by author 8 January 1998.

land attack standard missile variant. The advantages of all the missile systems proposed are the increased range and the varying types of warheads that can be incorporated. The warheads range from bomblets to anti-tank weapons with terminal guidance that enable them to hit moving targets.

To meet Navy and Army requirements to target and kill moving targets, submunitions are being developed that would be carried to the vicinity of the target by a missile, then deploy in a seek and destroy mode. The Brilliant Anti-armor Technology and SADARM submunitions can both be delivered by the competing missile systems and provide a moving target kill capability.[46]

DD 21 Land Attack Destroyer

The platform that will incorporate all these NSFS programs is DD 21. It will be equipped with the 5"/62 gun with ERGM round, the VGAS with its extended range munitions, and a land attack missile system. The first of the land attack destroyers is scheduled to be deployed starting in FY 2009 and will provide a significant leap in capability over the near-term NSF'S solution. The maximum capability of the near-term is dual 5"/62 guns with ERGM

[45] Townes, "NSFS: On Target," 25

[46] CAPT Dennis Morral, USN, "Naval Surface Fire Support: Enabling Maneuver Warfare," Surface Warfare 22, no. 4 (July/August 1997) 29.

rounds; anticipated capacity of the magazines is 300 rounds.[48]

The draft Operational Requirements Document for DD 21 requires a minimum of 128 vertical launch cells for land attack and TOMAHAWK missiles, and a 600 round capacity per tube system for the guns.[49] Current designs include 2—5"/62 guns, 2 VGAS systems plus the required 128 vertical launch cells.[50] This combination of fire support weapons systems will provide an extremely capable NSFS platform.

CURRENT AND FUTURE CAPABILITIES REQUIREMENTS

> Despite the predominant experience of the U.S. Navy in seapower projection operations, beginning during the Revolution with Penobscot Bay landing in 1779 and extending through the war with Mexico, the Civil War and the war with Spain, not a single gun system was designed with shore bombardment requirements in mind.[51]

As General Weller points out, based on the military experience of the United States, one should question the current lack of NSFS capabilities. He also notes that in World War II NSFS assets were a commodity that resulted

[47] Riccio Command and Staff College brief.
[48] Program Executive Office, Naval Surface Fire Support (PMS 429), Concept of Employment for Naval Surface Fire Support (Near—Term Capability), Draft Concept Paper, (Washington, DC: Naval Sea Systems Command, March 1997), 6.
[49] Chief of Naval Operations, Operational Requirements Document Draft for The Land Attack Destroyer (DD 21), 12 August 1997, 7.
[50] Riccio, Command and Staff College brief.
[51] Weller, "Background," 10.

more from coincidence than plan. The vast number of battleships and cruisers used in World War II for amphibious assault support were available because they could not accomplish their primary mission of defending the carriers. The advent of the new, faster carriers meant the old battleships could not keep up with the fleet task force and they were relieved of their carrier escort duties and became more available for fire support.[52]

Though the battleships were designed for fleet engagements and defense of the fleet/carrier force, they performed more than adequately in the role of shore bombardment. The same cannot be said for the guns in today's surface combatants. This lack of a gun designed specifically for shore bombardment is a deficiency today and the near- and long-term development programs designed expressly for the NSFS mission are a first.

The requirement for a NSFS weapon with extended range is not a new concept. The need for increased lethality up to 2ONM and a capability for neutralization effects at ranges of at least 5ONM were defined as early as l968.[53] The Navy was well aware, as stated by the Assistant Secretary for Research and Development, that:

[52] Weller, "Background," 10.

> the five-inch gun as it exists fulfills the requirements for guns in the ASEJW [anti—surface warfare] role -— with regard to larger diameter guns it is my view that the requirements ball is squarely in the Marine Corps ball park.[54]

Though the capabilities issues were acknowledged, a NSFS system was not procured and up until as recently as Operation DESERT STORM in 1991, the Navy has been forced to rely on recommissioning World War II battleships to meet its NSFS requirements.

Range Requirements

The ranges required for NSFS are a function of the standoff distance from the beach, required to avoid or minimize the enemy's coastal defenses, and the distance from the beach to the objective.

> [T]he distance we reach inland from the sea depends on terrain and weather, ... the potential adversary's capabilities and the nature of our mission. The mission may require us to exercise our considerable reach and operate far inland.[55]

"Far inland" is a capability that today is held by all portions of the operating forces except NSFS. The 5"/54 gun with its 13NM range can barely reach the beach without

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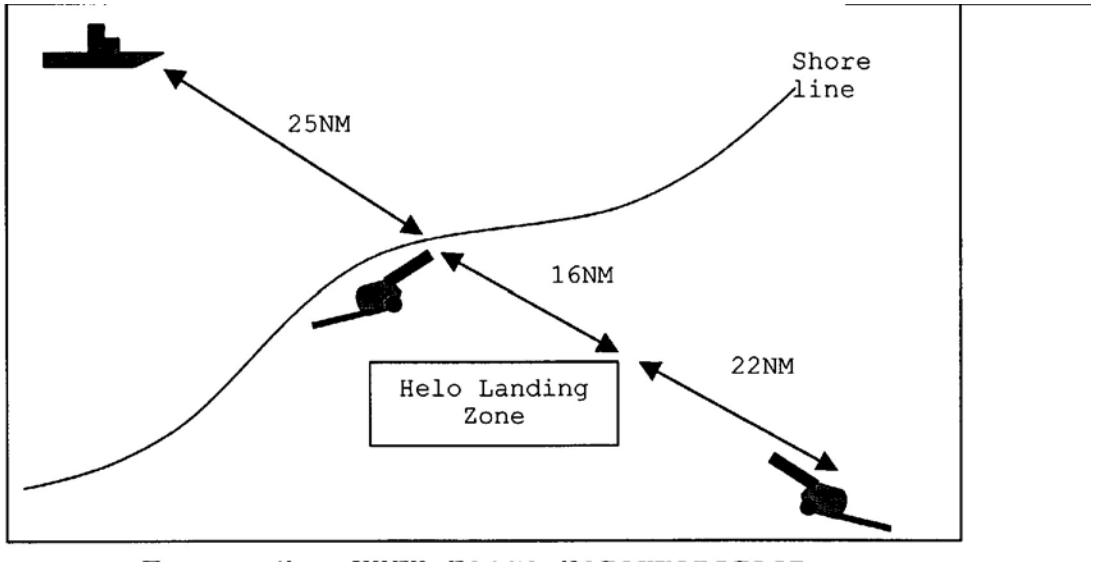
[53] Naval Gunnery Conclave, Proceedings of the First Naval Gunnery Conclave, 13 August 1968 (Dahlgren, VA: Naval Ordnance Systems Command, 1968), 3—1.

[54] Assistant Secretary of the Navy for Research and Development letter to Vice Chief of Naval Operations, 24 November 1980 as quoted in Weller, "Background," 9.

[55] Forward from the Sea, 2.

placing the ship within the firing range of almost every coastal defense gun or missile system currently available.[56] The development of an increased range weapon is therefore imperative to meeting any of the future employment concepts for NSFS.

The Marine Corps established a 63NM range requirement in l996.[57] This range was developed by adding a 25NM standoff from the beach, an inland range of l6NM to a helicopter landing zone (the range of protective fire from current artillery at the beach), and a nominal 22NM range to reach enemy artillery that could fire on the landing zone, see figure 3.



[56] Christopher F. Floss, ed., Jane's Armour and Artillery 1996—97, 16th ed. (Surrey, UK: Jane's Information Group Limited, 1996), 589, 778—811.
[57] Commanding General MCCDC letter to CNO (N86 and 85)

Studies conducted prior to the Marines stating a range requirement delineated distances from 75NM[58] up to 200NM, the later to incorporate the range capabilities of the MV-22. The 200NM range is also required to meet the current Major Regional Contingency operations plans. Objective ranges of 115 to 145NM are needed for both the West and East Major Regional Contingency plans, respectively, plus a 25NM standoff distance.[59]

The extreme ranges required for some scenarios will necessitate the development of a missile system to augment the capabilities of a long-range NSFS gun and munitions. The missile will require precision accuracy to perform artillery suppression and interdiction missions. Missiles would provide deep fire support while the supporting naval guns would still be required to reach the ground forces for covering, maneuver and call fires. Direct fire support for the maneuvering element must still be attainable by naval gunfire.

The OMFTS and STOM maneuver concepts rely heavily on NSFS to supply all means of fires for the troops ashore. The number of munitions required to directly support a unit in contact with an enemy would preclude the use of only missiles to support the unit due to the costs and numbers

[58] Morgan interview

of missiles that would be required. Covering the forces ashore in an OMFTS or STOM operation will therefore require naval gunfire support to meet the proposed ranges for these operational concepts. As defined in the letter from the Commanding General, Marine Corps Combat Development Command (MCCDC) to the Chief of Naval Operations; ranges up to 200 NM inland may be required.[60]

A comparison of these range requirements and the current programs under development provides mixed results. Though the ERGM round for the 5"/62 gun will meet the near-term range requirement of G3NM, neither the ERGM nor VGAS will reach the 200NM of the OMFTS and STOM scenarios. This shortfall will leave the maneuvering forces ashore vulnerable to enemy forces and their artillery with the inception of these concepts and the MV-22 in FY 2010.

Time Requirements

Time is a characteristic pertinent to call fires in NSFS. Responsiveness of call fires is the time it takes from receipt of the call to detonation on target. Pre—planned and coordinated fire support can accommodate greater times of flight since the fires are not in response to an immediate threat call fires are the critical element

[59] JHU, "Road Map Study Phase 1," 3-15.

in timing for NSFS. Call fires are "characterized by very short time requirements (minutes or less reaction time plus time of flight) because the targets are immediately threatening friendly forces."[61] The speed and accuracy of NSFS is critical to the survivability of the maneuver forces. With NSFS acting as direct support artillery for the Marines, maneuver tactics are only possible with immediate and devastating call fires.

The Johns Hopkins Road Map Study Phase 1 delineated response times for call fires as 2 to 10 minutes to weapons on target. It also stated that a minimum of 3 simultaneous call fires must be processed and executed to meet maneuvering force requirements. These criteria, if met, would allow engagement of some mobile systems, however, self—propelled vehicles and artillery would most likely not be suitable targets for a standard warhead, since once shelling commenced they would most likely move.[62]

With the advent and incorporation of automated call fire systems, the time to process target information and assign a platform and weapon system to the target is continuing to shorten. The Army and Marine Corps are

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[60] Commanding General, MCCDC letter to CNO (N86 and 85), Enclosure (1)
[61] Naval Doctrine Command, Naval Fires, A Concept for Seabased Warfighting in the 21st Century, (Norfolk, VA: Naval Doctrine Command, September 1997 (DRAFT)), 6.
[62] JHU, "Road Map Study Phase 1," ES—4, 3—12.

jointly developing the Advanced Field Artillery Tactical Data System (AFATDS) . This system will incorporate several fire support functions including communications, prioritization, target characteristics and weapons systems capabilities. This automation decreases the time to respond to call fires considerably and is a key to the future of NSFS.[63]

Another factor in the processing time for call fires is airspace deconfliction. In the past, airspace deconfliction was possible by assigning maximum altitudes for gunnery and minimum altitudes for TACAIR to provide separation. This strategy was first exercised in the battle for Guam in World War II and has been successful ever since.[64] The ERGM rounds attain altitudes of up to 80,000 ft. to reach maximum range. With these altitudes and a flight path that leads over the battlespace to the target, a 5 ft. projectile must be deconflicted with TACAIR operating along the ERGM's route of flight. Attempts to join land and air automation systems are being developed;[65]

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[63] PMS 429, Concept of Employment, 9, 10.
[64] Samuel Eliot Morison, New Guinea and the Marianas, March 1944 — August 1944, vol. 8 of History of United States Naval Operations in World War II, (Boston: Little, Brown and Company, 1953), 381.
[65] The Army AFATDS program is developing an interface to integrate the Air Force Contingency Theater Air Planning System (CTAPS) into the fire support decision process to deconflict scheduled aircraft sorties with call fires. LCol Joe S. Carter, USA, Warfighting Faculty, USMC Command and Staff College, interview by author, 12 March 1998.

the time for these systems to correlate air traffic and the ERGM flight path must be minimized.

Assigning the weapon and deconflicting the flight path leave time of flight as the final piece of responsiveness. Commanding General, MCCDC letter to the Chief of Naval Operations cites the response time as required by MCO 3501.6B, Marine Corps Combat Readiness Evaluation System, Volume V, Artillery Units as 2½ minutes.[66] If the automated systems took only 30 seconds each, one minute total to assign a system and deconflict airspace after receipt of a call for fire, the ERGM would have to fly 63NM in 90 seconds to meet the MCO requirements. A weapon would have to fly at 3.8 Mach to meet that time! Though meeting this speed requirement is not completely impossible, current gun systems cannot meet a speed requirement that high. The time of flight of NSFS weapons must still be minimized, and a more realistic standard must be set for the weapons based on distance requirements. The eight minute time of flight of the current ERGM is excessive for forces in enemy contact.

[66] MCO 3501.6B, Marine Corps Combat Readiness Evaluation System; Volume V, Artillery Units as cited in Commanding General MCCDC letter to CNO (N86 and 85), Enclosure (1).

Quantities of Weapons

Some fire effects require barrage type employment of weapons; others require weapons with pinpoint accuracy. The differences between the types of weapons available for NSFS is best described as:

> Rockets provide a means of massed fire power, delivering warheads at a high rate for a short period of time against area targets. Missiles provide the means for accurately delivering warheads against either area or point targets. Guns can provide a combination of the capabilities of both missiles and rockets, depending on the types of guns and projectiles available.[67]

The missions of area, neutralization and saturation fires require vast numbers of weapons with less accuracy than that of destructive fires.

These missions that require volume fires will, however, most likely be left to naval guns since the cost of missiles and rockets, and the numbers available would prohibit their use in such missions.[68] With the current cost estimate of a land attack missile at $300,000 per weapon,[69] these assets must be husbanded for their most effective use. NSFS gun munitions must therefore not only be capable of long-range precision fires, but also include

[67] NSWC NSFS Study, 18.
[68] NSWC NSFS Study, 4 – 5.
[69] Riccio, Command and Staff College brief.

a low cost, long—range, less accurate area fire munition to support the forces ashore. At the projected $5,000 per round of the current ERGM, the price tag for harassing or suppressing fires is still excessive.

NSFS WARGAMING EXPERIMENTS

During the development process of the NSFS systems and the development of OMFTS, several wargame scenarios were initiated to investigate the employment of NSFS weapons. The most notable of these scenarios and experiments are the Center for Naval Analyses "Project CULEBRA" studies, the John Hopkins University "NSFS Road Map Studies" and the Marine Corps "Hunter Warrior Experiment." These wargames, though using simulations for NSFS, provided valuable insight into the employment and effectiveness of NSFS in the battlefield of the future.

Project CULEBRA

Project CULEBRA was a joint undertaking of CNA and MCCDC. The project consisted of 2 wargames held in March and April of 1995 to examine a STOM type operation in the year 2010. The forces involved were a Marine Expeditionary Force (MEF) sized force augmented by a brigade of the 82nd

Airborne Division and a regiment of "Blueland" Marines.[70] Blue forces were the U.S. forces and allies, Orange forces were the enemy. The objectives of the amphibious force were:

- Prevent resupply of Orange forces to the south
- Fix second and third echelon Orange forces
- Prevent the flow of reinforcements south[71]

The landings were conducted in a 4-phase operation. Phase 1, initial insertion of forces, consisted of three airborne insertions of: (1) an infantry battalion to secure a road junction and prevent Orange forces from moving to d the beach, (2) the 82nd Airborne Brigade to commence offensive operations and secure the enemy main supply route (MSR), and (3) an infantry battalion to secure coastal artillery sites.[72]

Phase 2 was the main assault that consisted of three landing sites. An airborne insertion of an artillery battalion and a mechanized battalion to assist the securing of coastal and mobile artillery. A mechanized battalion was landed on the beach and proceeded inland to act as the blocking force along the enemy MSR. Finally, a mechanized

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[70] Center for Naval Analyses, Project CULEBRA: MCM Follow—on Wargame, Study, CRM 95—93, June 1995, 6.
[71] Center for Naval Analyses, Project CULEBRA: Analysis of Fires Requirements to Support Ship—to-Objective Maneuver, Study, CRN 95—110, June 1995, 7 — 8.
[72] CNA, CULEBRA: MCM Follow-on, 13.

battalion was landed and directed to assist the infantry battalion and artillery of the initial insertion. The final two phases consisted of airborne insertions and amphibious landings to reinforce the initial landings and main assault.[73]

During the operation, there was no consolidation of the beachhead and the objective was reached on the same day as the landings. NSFS was used against platoon to company sized units and specific targets such as: Command Posts, truck parks, supply dumps, and artillery batteries. No preparatory fires were used and on D-day (the day of the landing), however, there were 76 pre—planned targets assigned to D—day fires. The number of targets increased daily throughout the scenario.[74]

Once the Blue forces reached their objective they were able to "dig—in" on the defensive. Enemy forces were required to leave prepared positions to dislodge the Marines. This movement exposed the Orange forces to long-range NSFS. An overall force size comparison of this operation held Orange forces at about 4 Divisions and the Blue forces at 1 2/3 Division. Consequently, any major effort by Orange could mass more forces against the

[73] CNA, CULEBRA: MCM Follow-on, 15 - 18.
[74] CNA, CULEBRA: Analysis of Fires, 7 — 8.

separate Blue units. Established defensive positions aided in the defense,

> but capable and responsive fires are clearly needed to support the landing force. And because of the space on amphibious ships is limited, much of the supporting fire will have to come from other assets — NSFS ships and aircraft carriers.[75]

In this wargame, an attack was made against the minimal Marine forces at the beach and another attack was made to sever the Blue force lines of communication. Both of these required NSFS at less than the maximum range. Had the enemy massed an attack against the main force blocking on the MSR, ranges for NSFS would have been at and beyond the maximum capabilities available. A lack of NSFS would have severely degraded the defenses of the smaller Marine force and had a direct assault been made by the larger enemy forces the mission might not have succeeded.[76]

This scenario was similar by design to one of the current Major Regional Contingency plans. The inadequacy of range of NGFS for the maneuvering forces ashore could not provide covering or call fires to the objective area. It was still farther short in range of enemy artillery had it been emplaced to reach the Blue forces at the objective. Even in this scenario with an organic artillery capability

[75] CNA, CULEBRA: Analysis of Fires, 52.
[76] CNA, CULEBRA: Analysis of Fires, 51 — 52.

the lack of fire support would have been extremely costly had a counterattack occurred at the objective.

Johns Hopkins University Road Map Study Phase 2

Phase 2 of the Road Map Study was designed to develop a quantitative analysis of NSFS for a variety of scenarios and conditions. A portion of this analysis was the Surface Combatant Land Attack Weapons Study, performed from August through December 1996. This analysis compared the effects of operating with various combinations of NSFS weapons. NSFS consisted of the 5"/54 current gun system, 5"/62 with an ERGM round and a 155mm VGAS. Sixteen naval gun fire ships in varying combinations of 5"/54s and 5"/62s were examined with a maximum of 11 5"/62 equipped ships. Up to 3 VGAS ships were employed in addition to the 16 NGFS ships. The ERGM rounds (5"/62 and VGAS) carried a DPICM submunition, the 5"/54 fired a High Explosive round. The ground forces were equipped with 3 battalions of the Light Weight 155mm Howitzer (54 tubes) and TACAIR was available at a rate of 300 fixed wing sorties per day.

The scenario employed a MEF sized unit (23,000 Marines) in a Major Regional Contingency. The mission of

[77] Johns Hopkins University Applied Physics Laboratory, Naval Surface Fire Support Road Map Study Phase 2, Flag Oversight In-Progress Review, Study, JWR—97—004, March 1997, 8, 14, 15.

the Marines was to perform an amphibious landing in sufficient strength and speed to take up a blocking position along the enemy's lines of communication. OMFTS type insertions were used with no consolidation at the beachhead, but maneuver over the beach to the objective.[78]

The insertion was conducted in a three phase assault which included: (1) a vertical assault by an allied battalion of Marines directed against an enemy Corps Artillery Group, (2) a vertical assault of an infantry battalion and artillery battalion to establish a blocking position and fire base along the enemy route of advance, and (3) the remainder of the MEF performed a forced entry along the coast.[79] The forces arriving over the beach were tasked to link-up with the blocking force, then to take and hold a crossroad against a counterattack. The action took place on a coastal plain 15km wide bounded by water on the east and steep vertical mountainous terrain on the west. The NGFS ships were able to maneuver freely to within 5NM of the coast, VGAS platforms remained outside 25NM.[80]

A comparison of the lowest support level of 16 – 5"/54s and field artillery support, to the maximum support

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[78] JHU, "Road Map Study Phase 2," 13.
[79] Alan Zimm, Program Analyst, Joint Warfare Analysis Department, Johns Hopkins University Applied Physics Laboratory, interview by author, 12 March 1998.
[80] JHU, "Road Map Study Phase 2," 14, 15.

of field artillery plus NGFS supplied by 11 - 5"/62 ERGM equipped ships and 5 — 5"/54s produced significant differences. The scenario determined that the numbers of Armored Combat Vehicles (tanks, Armored Personnel Carriers and Infantry Fighting Vehicles), available to each force at the major engagement, the counterattack at the crossroads, were decisive in the outcome. With no NGFS, the enemy commenced its counterattack with 197 ACVs vice only 70 for the Marines. The Marines had lost 25% of their vehicles prior to reaching the final engagement and would most probably have been defeated by the counterattack (mission success was defined by the ability to hold the crossroads) In this case, the 5"/54 was able to disrupt some enemy artillery fire, however, the enemy force's artillery and multiple rocket launchers had a severe impact on friendly forces.[81]

With NGFS of 11 - 5"/62s with ERGM rounds and 5 - 5"/54s, 51% of the enemy ACVs were attrited prior to the counterattack. This resulted in 122 Marine ACVs available vs. 90 for the enemy, and a Marine victory. The losses of Marine forces and equipment were reduced in all categories with the incorporation of NGFS, while enemy losses increased making the total force exchange ratios

[81] JHU, "Road Map Study Phase 2," 19 - 21.

significant; in this case the difference between winning or losing the engagement. The combination of being able to range the enemy artillery with additional fire support assets and the greater kill capability of the submunition made the difference in fire support effectiveness.[82]

Hunter Warrior Experiment

The Hunter Warrior experiment was conducted at Twenty-nine Palms, CA from 1 to 12 March 1997. The experiment was conducted in three phases. Phase 1 consisted of reconnaissance, surveillance, target acquisition, shaping and deception operations. Phase 2 developed into initial engagements, enhanced targeting, and long-range indirect fires. The culmination was Phase 3 — the major engagement.[83]

In this experiment a MEU sized Special Purpose Marine Air Ground Task Force engaged a mechanized Marine regiment. The opposing regiment was a larger, well-equipped force. The commanders of both forces were given mission goals, however, they were free to execute the missions as they saw fit. NSFS consisted of land attack missiles with either

[82] JHU, "Road Map Study Phase 2," 19 — 21.
[83] Marine Corps Warfighting Laboratory, Hunter Warrior Advanced Warfighting Experiment Reconstruction and Operations/Training Analysis Report, Study, August 1997, A-3.

general purpose or anti-armor warheads, and 5-inch guns with ERGM and conventional rounds.[84]

Employment of NSFS resulted in the almost exclusive use of the 5-inch gun with ERGM round. Of the 680 indirect fire support missions during the experiment, 407 were allotted to the ERGM. The ship-launched missiles accounted for 55 missions, this number reflects the high cost of the missiles and probable small numbers allotted to the Marine ground forces. To accomplish the 407 fire missions, 2,381 rounds of the ERGM were required with an average of 6 per Mission[85] (this is comparable to the 8 rounds per mission of the Project CULEBRA study[86]).

Two major conclusions were derived from the extensive use of the ERGM during this experiment. First, with its GPS/INS enroute guidance and no terminal guidance, the ERGM is very ineffective against mobile/moving targets. Due to the time of flight (8 minutes), and the fact that the munition is aimed on a set of coordinates on the ground, a mobile target is likely to have moved from the geographic aim point and out of the destructive range of the munition by the time of impact.

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[84] MCWL, Hunter Warrior, A-4.
[85] MCWL, Hunter Warrior, H-9 – H-18.
[86] CNA, CULEBRA: Analysis of Fires, 42.

Second, the number of rounds fired at a specific target did not necessarily increase effectiveness. In classical NGFS, more shells on target (aimed at the same point) increased effectiveness. The increased effectiveness was most likely due to the inherent errors in the accuracy of the unguided munitions; i.e., more shells would eventually saturate a specific area. With a guided munition, more shells aimed at the wrong point only increased the number of shells missing the target. This is a major change in the philosophy of Naval Gunfire, and for area targets, delineates the possible requirement to induce errors, or aim each guided munition at slightly different points in the vicinity of the same target to increase the kill capability of the weapons.[87]

SOLUTIONS AND SHORTFALLS

The battlefields of the future will not be that different from those of the past in terms of fire support, only the ranges will be different.[88] Executing Operational Maneuver from the Sea or Ship-to-Objective Maneuver will not be that different from the naval gunfire support of

[87] MCWL, Hunter Warrior, H-9 – H-19.

World War II in the Sicilian Campaign. Preparatory bombardment of the beach (or helo/MV-22 landing site in the future) will be held until such a time that enemy units will be unable to react and interdict the landing site until after the forces are established. NSFS ships will provide interdiction and suppression fires to allow the forces to maneuver to their objective, destroy preplanned targets and supply call fires in support of enemy engagements just as Naval Gunfire Support provided these fires for General Patton during his advance along the north coast of Sicily. NSFS will be a critical requirement for any amphibious operation and a significant contribution to any land operations within their firing range.

> NSFS weapons can have significant effect on the battlefield. ...the difference between success and failure. The magnitude of the impact ... where less than a dozen modernized NSFS systems doubled the effectiveness of a Marine Expeditionary Force sized unit.[90]

NSFS will rely on gun launched munitions to deliver the large quantity of supporting fires due to its relatively lower cost and resupply capabilities.[91] The major issues still affecting the gun are range, time of

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[88] MGEN Donald M. Weller, USMC (Ret), Naval Gunfire Support of Amphibious Operations: Past, Present and Future, (Arlington, VA: Universal Systems, Inc., October 1977), 46.
[89] Samuel Eliot Morison, Sicily—Salerno—Anzio, March 1943 — June 1944, vol. 9 of History of United States Naval Operations in World War II, (Boston: Little, Brown and Company, 1954), 174, 175, 191, 192.
[90] JHU, "Road Map Study Phase 2," 34.

flight and cost for a high volume munition. The near-term solution will provide some capability to be effective in an amphibious operation, but the range will not meet the majority of circumstances encountered. The 63NM range fell short of the original Cost and Operational Effectiveness Analysis, the JHU Road Map Studies (Phases I and II) and the Project CULEBRA analysis ranges. Naval gunfire must be able to reach the vicinity of OMFTS/STOM objective areas to defend the landings and interdict enemy forces and enemy indirect fire weapons targeting the objective area.

The time of flight of the ERGM will be a constant source of consternation for those calling for supporting fire. When the enemy is on the move and suppressing or interdicting fires are required, an eight minute time of flight will not hit the target, it will have moved somewhere else, and once the first round hits everyone will be moving. In a maneuver engagement, the long time of flight for call fires could result in friendly forces underrunning their supporting fires, maneuvering into the target areas after the weapon has been launched. Efforts are being made to reduce the decision time for call fires, time of flight must also be reduced to minimize response time.

[91] NSWC, NSFS Study, 5.

The increased capabilities of NSFS systems have also increased their price. The $300,000 per missile cost of a land attack missile will ensure these assets are used for specific purposes/targets with a high probability of success. NGFS must therefore be available for volume/barrage type fire missions. At $5,000 per round (the anticipated full—rate production cost), continuous harassing or suppressing fires will quickly accrue a significant price tag. The 2,381 ERGM rounds used in the 12 days of operations in the Hunter Warrior Experiment would have cost 11.9 million dollars, only processing 407 targets. This will be a high price to pay when the purpose of firing these weapons is only to make the enemy "keep their head down" during a landing, maneuver, or extraction. A lower priced, less precise, volume munition is necessary to accomplish all the fire missions of Marine Corps future operations.

The Navy's near— and long—term programs represent significant improvements in the realm of NSFS. It is imperative that continued developments occur in range, response time, and a low—cost volume munition with increased range. Without these improvements, Marines operating at the ranges anticipated in OMFTS and STOM will

be unnecessarily exposed to enemy fires throughout all phases of an amphibious operation.

APPENDIX A: GLOSSARY OF FIRE SUPPORT TERMS[1]

Fire Missions

Direct Support. A ship delivers prearranged and call fires for the supported unit. Call fires are normally requested and spotted by a shore fire control party or an air spotter. Each assault battalion is normally assigned one direct support ship.

General Support. The fires of ships in general support are conducted as directed by the naval gunfire liaison officer of the unit being supported. The primary purpose of general support is to increase the capability of the direct support ships by providing additional firepower to the supported commander without having the request go through higher echelon commanders. Fire missions against targets of opportunity and prearranged fires are conducted directly by fire support ships as provided for in the NGF plans. Units of regimental size or larger, not in reserve, are assigned one or more general support ship.

Fires for Effect

Destruction Fire. Fires for the sole purpose of destroying material objects. Spotting is required.

Harassing Fire. Fires to disturb the rest, curtail the movement and by threat of losses, lower morale of enemy troops.

Interdiction Fire. Point or area fire to prevent the enemy from using the designated area or point; e.g., roads, rails, lines of communication.

Neutralization Fire. A fire of temporary effect to hamper or interrupt the movement and/or firing of weapons.

[1] Definitions of terms from NWP 3—09.llM, 2—2, 2—4, 2—5.

Suppression Fire. Effective only during the duration of fire, it temporarily degrades the enemy's capability to place fire on friendly forces.

Tactical Fires

Close Supporting Fire. Coordinated fire in close proximity to friendly troops on enemy troops, weapons or positions.

Counterfire. Fire directed at enemy weapons for destruction or neutralization.

Countermechanized Fire. Fire against enemy mechanized units.

Deep Supporting Fire. Any type of fire effect on objectives not in the vicinity of friendly forces.

Defensive Fire. Fire to defend or protect forces in a defensive action.

Obscuration Fire. Fire of specifically designed munitions to obscure the enemy's view of the battlefield.

Preparation Fire. A volume of fire prior to and in support of an assault.

Protective Fire. Fire on the enemy during reorganization after the capture of a position.

Reconnaissance Fire. Fire on a suspected enemy position that discloses his position by return fire or his movement.

Screening Fire. Masking of friendly maneuver and concealing of operations by use of specialized munitions.

Suppression of Enemy Air Defenses Fire. Destruction, neutralization or temporary degradation of enemy air defenses 'by fires.

Types of Fire

Area Fire. Volume of fire delivered to a delineated area.

Call Fire. Fire delivered on a specific target as requested by the supported unit.

Pre—arranged Fire. Formally planned fires against specified targets or target areas at a predetermined time or on call.

Precision Fire. Observed fire, corrected by a spotter to increase accuracy, for attack and destruction of point targets.

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